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INNOVATION PROCESSES AND "LEARNING COMMUNITIES" IN COLOMBIAN SMEs

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INTRODUCTION

The objective of this paper is to analyze the common characteristics of five innovation processes carried out by a small Colombian company (hereinafter "the company"), under my direction and with my direct intervention, over a period of seven years. Thanks to these projects, the company significantly increased its competitiveness and had some Colombian academic and entrepreneurial awards conferred upon it (INNOVA-2004, INNOVA-2007, ACAC, MONEY MAGAZINE).

The creative destruction paradigm (Schumpeter, 1934; Schumpeter, 1942) suggests that in turbulent environments one should be the creator of one's destruction in the present (defeat one's current lack of competitiveness), in order to remain competitive in the future. Thus, this attitude toward change and innovation becomes a centerpiece in the long way toward competence building and competitiveness.

The projects were carried out with a shortage of resources, a common feature of small and medium enterprises in developing countries. They maintained a systemic approach regarding the company's competitiveness and assigned an important role to organizational learning. The cases are: No. 1, Workforce-Performance-Software, No. 2, ERP Software (Sales-Production-Materials), No. 3, Extraction-Manipulator-Cups-Printer, No. 4, CRM Software (Sales, Receivables and Marketing), and No. 5, Four-To-Five-Colors-Printer-Reconverting.

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Traditionally, the stance of research in organizational innovation has been carried out by three different and independent theories: (a) organizational capacity for change and adaptation, (b) innovation as a process of organizational learning and knowledge creation; and (c) the relationship between organizational structural forms and innovativeness. The analysis of the projects carried out by the company develops a coherent articulation of these three fields of research and leads to a "holistic" understanding of organizational innovation.

These technological innovations show how, for the company, learning and innovation are carried out by people. Technology and innovation come from people's activities and people's will to innovate. That is the reason why the new management decided to promote "meaning" and "sense" around change, innovation and situated action. By deploying this strategy, the company got its people to behave as "agents of change" rather than patients of "change". In this context, the management was able to direct the organization as a whole toward change and innovation. With these activities, people changed their own expectations and began the self-construction of what was meaningful for themselves. In addition, this interactive learning space became, for all of them, including the company, a place where things could happen, where change could be possible.

Regarding the relation between the firm's structure and its innovative capacity, the paper analyzes the company's historical competitive profile vis-à-vis its environment and subsequently shows how, by means of a hiring mechanism of its new General Manager, myself, the enterprise created an interface structure between the company and its environment. This interface structure profited from the "relational capital" (Richardson, 1972) the new management mobilized within and outside the organization. This relational capital was dynamically reconfigured to respond to environmental demands and endogenous capabilities. Clearly, this interface structure facilitated the establishment of an Open Innovation Model. After putting this model in place, the company crystallized its activities of change and innovation and took advantage of this interface structure to rapidly respond to the environment and assure the proper in-flow of limited resources (knowledge, time, money, etc).

The study reflects on the issue of scarcity of resources, not just in the context of SMEs, but in developing countries, and stresses, in light of the experiences analyzed, the relevance of designing policies to foster a relationship among actors in the context of the National Innovation System (Arocena & Sutz, 2000).

Section 1 describes the company's competitive profile, its structure, and its attitude and dynamics toward change and innovation. Section 2 examines how the company coupled its evolution and technological change with the correct identification of opportunities and risks present in its environment. Section 3 deals with organizational learning and knowledge creation through settlement of an interactive and iterative learning space for innovation activities. Section 4 presents the main conclusions of the paper and suggests some fields for future research.

1. COMPETITIVE PROFILE AND CHANGE

1.1 COMPETITIVE PROFILE

The Innovation cases to be analyzed took place in a small Colombian plastic injection molding enterprise, working 24 hours a day and 7 days a week. It has around 60 employees, a 200-item product portfolio and a plant capacity underpinned with 12 machines (worldwide cutting-edge fast-injection machinery). The company faced a turbulent environment and was a small player constantly following the Big Players. Four percent of its human resources had professional qualifications and were dedicated to management activities; 10% were technicians devoted to different support activities (accounting, maintenance, quality, etc), and 86% had basic or secondary education and were committed to production activities or activities related to the plant. Given its character as a small player, the company's strategy focused on strengths such as quality, cutting-edge technology, a wide portfolio (both clients and products) as a means to shrink its exposure, lean direct operational costs and a rapid response capacity. On the other hand, the company's weakness came from totally reactive behavior, a low capacity for technological absorption and a total incapacity to promote processes of competence building (human resources, formalizing supporting process or planning processes). The main strategy in place was to "survive" based on the above-mentioned strengths, although immersed in an everyday work world of chaos and an endless routine of reactions. The situation was even worse if we take into account people's feelings about themselves and about the company's strategy: what was clear to management was that the company's competitiveness rested on machinery and its lack of competitiveness on its poorly qualified human resources and the web of informal or non-existent processes related to key areas. As a result, both the company and its employees saw themselves submerged in an endless routine of urgencies, problems and improvisation.

1.2 "MEANING" CONSTRUCTION AROUND CHANGE

Section 1.1 described the company's situation before a new administration headed by me began carrying out its functions. This new administration, after seeing itself in a chaotic and reactive dynamic, decided to focus its plans on the establishment of a "change" strategy, which drove the company to change dynamics and to become a more proactive player within its market. Secondly, we realized that change depended more on the number of "agents" of change than on the number of decisions taken by its administration. In this context, the first step was to promote an idea of change as something "possible" and "worthwhile," both for the company and its employees. In other words, the first step was to generate a climate and attitude favorable toward change and innovation.

These "sense" and "meaning" constructions began with project No. 1, Workforce-Performance-Software. The project was designed and implemented in 12 months (three in designing activities

and nine in implementing activities), and all of the employees of the enterprise participated in its design. Through this "participative" scheme, employees got the opportunity to shape their activities and, at the same time, to design the method by which they were evaluated and of the methodology to identify and reward good employees (both relevant aspects for them and for the Company). For the enterprise, the process was the opportunity to cast those aspects that it wanted to promote. This project included a reward system based on the values of "justice" and "trust," both "valuable" for the change and innovation climate. The project generated an invaluable externality: it settled the idea that change was "attractive," "possible" and "real" for the organization as a whole. From the beginning, workers saw themselves as "agents" of change rather than patients of change, as has been always the case with poorly qualified human resources in front of technology change.

1.3 CHANGE: INTEGRATING ROUTINES WITH EVOLUTION STRATEGIES

From the beginning, the new management framed the company's activities with change and evolution, in light of Lall's analysis of technological change and technological capabilities (Lall, 1992). We adapted the results of the analysis to the SME context (Chart No. 1- Appendix). The adaptation consisted of grouping any company's capacities into four main functional processes: Process-Engineering, Product-Engineering, Everyday-Supporting-Activities and Pre-&-Investment-Activities. Subsequently, management identified the different activities according to their complexity, that is, according to their closeness with the company's daily routines. (The company is a focal point in the chart.) This chart facilitates the identification and definition of evolutionary paths by which the company can design sound strategies to improve everyday activities, take advantage of the actors in its environment and direct the evolution of its practices toward complex activities that can lead to new technological capabilities (technological learning, evolution, innovation) (Nelson, 1986).

2. ARTICULATION OF OPPORTUNITIES AND RISKS WITH EVOLUTION AND TECHNOLOGICAL CHANGE, STRUCTURE DESIGN

2.1 OPPORTUNITIES AND RISKS IDENTIFICATION

After generating "meaning" and "sense" around change (section 1.1) and integrating daily operations with possible evolutionary strategies (section 1.3), the innovation dynamic began by identifying those innovation projects that could be "valuable." Here again, we combined two streams of research: the Chain-Linked-Innovation Model (Kline & Rosenberg, 1986) and Technological Capacities Evolution Theories (Lall, 1992; Nelson, R 1986). The former considered innovation as "staying even in the marketplace", clearly attached to a notion of the market (Market Push), and permanent linkages among the different stages (design-development-production-market). The latter concentrated on the evolution of technological capacities (Technology Push). In order to coordinate them, we at the company chose its innovation projects in its relation with market opportunities (expressed needs, latent needs, problems to be solved in order to better serve the market place, a 1-to-1 contact with markets and customers, etc.), and subsequently, the company linked this competitive challenge with the activities and operations that should evolve. In this context, routines and problems are linked to innovation as problem

solving (Arocena & Sutz, 2001), and at the same time, this link stressed one of the main characteristics of successful innovations: the "coupling" process between technology and the market (Freeman, 2004).

So, Project No. 1, Workforce-Performance-Software (quality control under Lall´s analysis), was the answer to customer demand for "correct" deliveries (right amounts, right quality, right product presentation, etc); Project No. 2, ERP (scheduling and monitoring control under Lall´s analysis), was the answer to shorten lead times and to diminish lost sales, both resulting from having too many clients, too much product and too few machines; Project No. 3, Extraction-Manipulator-Cups-Printer (process adaptation and cost saving under Lall´s analysis), was the response to customers' demands for printing service at lower prices; Project No. 4, CRM (monitoring and improved coordination under Lall's analysis), was the response to a need for direct contact with clients and proper management of the company's credit requirements; Project No. 5, 4-To-5-Colors-Printer-Reconverting (assimilation of process technology and in-house process innovation under Lall's analysis), was the response to customers' demands for multicolored capabilities that better fit their logos.

As it's been shown, the new management applied Hirschman approach on development:

"…Development depends not so much on finding optimal combinations for given resources and factors of production as on calling forth and enlisting for development purposes, resources and abilities that are hidden, scattered, or badly utilized." (Hirschman, 1958).

2.2 ENVIRONMENT-STRUCTURE AND INNOVATION-STRUCTURE.

Section 1.1 showed that the company's competitive profile corresponded to that of a small player with lean labor costs, thin decision-making structure and cutting-edge technology. In light of these characteristics, the company's structure could resemble the Mintzberg's archetype of "Simple Structure": an organic type centrally controlled by one person but able to quickly respond to changes in the environment (Mintzberg, 1979). Section 1.1 also illustrated the company's traditional incapacity to deploy or plan any dynamic internally or oriented to its environment.

Taking advantage of a hiring scheme for the company's general manager post, the enterprise altered its organizational structure toward change and innovation in an interesting way: the new general manager, myself, worked half-time as general manager of the company and simultaneously worked half-time as general manager of a productivity consulting enterprise. This situation allowed the new manager to play the role of structure of interface (Castro-Martínez, Fernández-de-Lucio, Molas-Gallart, 2006) between the plastic company and its environment and to spread his "relational capital" inside and outside the company by introducing, as expressed by Arocena & Sutz, the "outside world" quite naturally and in direct contact with the firm's behavior (Arocena & Sutz, 2001). This mechanism promoted the in-flow of a whole set of knowledge and capacities present in the environment and eased the establishment of an Open Innovation Model that took advantage of the company's capabilities (learning by using, learning by practice and learning by interacting) and dealt with the missing and needed specialized knowledge (that identified by academia and that figured out by the company's suppliers, respectively) to

strengthen the innovation activities undertaken. In addition to these features, the fact that the model was designed and implemented by the top management incorporated some "reality" and "certainty" into the innovation processes and to the perceptions of all of the actors involved, something very important at the initial stage of innovation processes.

In this context, through Project No. 1, Workforce-Performance-Software; No. 2, ERP; and No. 4, CRM, the manager brought from the environment his expertise as manager of the other consulting firm in information systems and deployed IT platforms (those that do not require technology infrastructure or qualified personnel). Project No. 3, Extraction-Manipulator-Cups-Printer, integrated academia's knowledge in robotics and manipulators and those of suppliers in pneumatics and automation. Through Project No. 5, 4-To-5-Colors-Printer-Reconverting, the firm incorporated academia's knowledge of design and simulation software and that of suppliers concerning materials and mechanics of materials. Another important factor to keep costs low and facilitate actors' appropriation of the processes was to design and schedule all activities in a way that was not "invasive" of actors' routines but complementary to them (not invasive innovation routines). It is important to stress that if those projects had been designed as "formal projects," that is, with objectives, activities, chronograms, budgets, purposes, etc., they would surely have been perceived as intruding in people's work and regarded as being at odds with the company's daily activity, something that could lead to a lack of appropriation of innovation.

By acting in such a way, we facilitated people's appropriation and sense making and got the following results. First, for the employees, such activities were the opportunity to "collaborate" in the building of the company and a valuable way of showing themselves to the top management. Second, for the academics (university professors and students who participated in the projects), such intervention constituted a means to get in touch with real problems and real solutions, a situation that is not easily available to them. And third, by making suppliers part of the projects as well, we gave them an excellent occasion to explore and validate new ideas and workable solutions.

As a result, the company moved from the incapacity to develop any dynamic regarding change and innovation to generating such processes in a successful manner at a very low cost and without circumventing everyday working. At this point, the company's capacity to innovate resembles more the archetype of "adhocracy": a highly flexible project-based organization designed to deal with instability and complexity. Problem-solving teams could be rapidly re-configurated in response to external changes and market demands (Mintzberg, 1979).

2.3 DEVELOPING COUNTRIES: SEARCHING FOR NEW EMPHASIS FOR THEIR NATIONAL INNOVATION SYSTEMS

The paper has shown how small enterprises facing an uncertain environment and with a scarcity of resources almost always react late to their environmental demands. Such situations hinder all dynamics for planning, innovating or competence building that are worth pursuing. It's important to highlight that those situations are common not just to the vast majority of SMEs in developing countries, but also to these countries themselves.

After analyzing the company's starting point and then the dynamic it generated, the paper endorses the relevance of the "quality" and "quantity" of relationships among actors. If this relevance was true for the company, it could be also true for National Systems of Innovation (NSI) in developing countries, whose capacities are limited and resources scarce. So, policies regarding NSI should focus on fostering actors' "relationships" instead of strengthening each actor's capability. In developing countries, enhancing each actor's capability could lead to the creation of expensive capabilities that are not socially used (examples: irrelevant academic research vis-à-vis its context; enterprises that operate disconnected from their environment, high performance products without markets; human resources without adequate competences, etc.). Undesirable results that notably enhance Freeman's conclusions:

"..the coupling mechanism between the education system, scientific institutions, R & D facilities, production and markets have been an important aspect of the institutional changes in the successful "overtaking" countries. These qualitative and institutional aspects of the problem have perhaps been underrated by comparison with the quantitative issues of scale of investment, annual expenditures, etc" (Freeman, 2004 (566)).

The aim of NSI is to promote change, innovation and competence building, not only by strengthening each actor's capacity but also that of the system as whole. When each actor's knowledge and capacities are socially used beyond his/her own boundaries, the system is enriched as whole, because his/her knowledge is applied inside others' context, thereby giving rise to the enhancement of the relational capital both of the system and of the actor.

3. INTERACTIVE-ITERATING LEARNING SPACES: COMMUNITIES OF PRACTICE, KNOWLEDGE AND INNOVATION

This section deals with the domain of the "Validation-Space" and the "Social-Context." The former is the place where innovation activities and personal insights are socialized ("ba" as a shared space for emerging relationships [Nonaka, I. & Noburo, K., 1998]), and the latter, the place of the social dynamics surrounding innovation activities and the patterns of actors' interaction.

3.1 VALIDATION-SPACE

Regarding the "space," the analysis shows the enterprise commitment to both the "physical" and "richness to perceptions" aspect of this space. This is so basically for two reasons: first, the need to quickly materialize (2-dimension, 3-dimensions, reality representation, etc.) where testing and socialization are easy to do; and second, to take advantage of the practical knowledge and capabilities residing in a company's employees (fundamentally tacit knowledge: user-knowledge, practitioner-knowledge, performance-knowledge, etc). This aspect of employees' role in innovation clearly highlights Kline and Rosenberg's ideas regarding innovation and science: "…what we need to recognize clearly is that most innovation is done with the available knowledge already in the heads of the people in the organization doing the work" (kline & Rosenberg, 1986).

Thus, in Project No. 3, Extraction-Manipulator-Cups-Printer, and No. 5, 4-To-5-Colors-Printer-Reconverting, the validation space was the machine itself and some university laboratories. In this place, actors gathered to generate and validate ideas.

Here lies an important characteristic of that dynamic: the meetings at the space took place every week at lunch time for two hours to discuss, to explore ideas. After each meeting, each internal and external actor was in charge of some task or compromises to be presented and socialized in the next gathering. In this context, artifacts both physical and digital were fundamental to translate personal insights into collective knowledge and dialogue construction on this basis.

Because this validation space gathered different disciplines and people with different backgrounds, the determinants of a potential solution involve the integration of these different skills in a framework of action and in a specific context of application, what makes the solution Transdisciplinary, in the sense that the final solution was beyond that of any single contribution discipline (Gibbons, et al. 1994).

3.2 SOCIAL CONTEXT

The other main aspect of the learning and knowledge creation strategy was the social dynamic put in place regarding innovation activities: first, each actor contributed from his/her background (tacit knowledge, codified knowledge, real-life expertise and so on); second, interaction and iteration (dialogue, discussion, experience sharing, observation, [Nonaka, 1994]) took place within the group. Through a constructive dialogue all disagreements were settled through testing and experimentation.

Each actor's "time" was the most valuable and scarce resource, and as mentioned above, this fact guided how activities were designed. Another feature of the knowledge dynamic was to base knowledge sharing principally on tacit knowledge as a way to make things happen faster. In one innovation, only when tacit knowledge failed to supply the needed information, explicit knowledge was commanded (artifacts, models, simulations, etc) in order to support and complement the former.

In this context, a craftsman was an expert in machine performance, a student was an expert in simulation and in understanding its results, a technology supplier was an expert in what was feasible and what worked in the technology he/she mastered, a maintenance technician was an expert in assessing whether or not designs were reliable. Through their interactions and by means of a dialogue construction that enriched each actor's insights, innovations emerged.

In many respects these experiences were consistent with the ideas of Wenger (1998), who stresses that through interactions and iterations each actor realized that building an identity consists of negotiating the meanings of our experience of membership in learning communities.

CONCLUSIONS

The analysis presented above about the common characteristics of five innovation processes carried out by a small Colombian company, under my direction and design, has integrated the

evolutionists theories with the firm's choice and organizational learning, in a coherent way. The paper illustrated how the company's choice and evolution supported by an Open Innovation Model facilitated learning, change and innovation.

The study stressed the main features of organizational innovation in the company: (1) "sense" and "meaning" construction around change and innovation; (2) an interface structure that enabled the establishment of an Open Innovation Model (market-driven) that took advantage of the company's endogenous capabilities and new-management "relational capital"; (3) the establishment of an interactive-iterative learning space for innovation activities under some special dynamics.

The analysis showed how the enterprise succeeded in bringing "sense" and "meaning" to change and innovation throughout the organization as a whole and how, by acting on the base of the organization, it transformed people's perception so that they behaved as "agents" of change rather than as "passive actors" of change, making them realize that their situation and that of the company depended on their actions.

In the realm of opportunities and risks identification and its relation with innovation activities, the paper integrated the chain-linked model of innovation processes (market pull) with Sanjaya Lall´s analysis on evolution and technological capabilities (Lall, 1992), showing how innovation process activities were put together with actors' and employees' routines. Similarly, the paper stressed the importance of a proper articulation between firm's structure theories and the innovation capacities, highlighting the relevance of its interface structure, "relational capital" and open innovation models in situations in which firms face uncertain environments (rapid response) and shortage of resources (searching for the missing resources in the environment).

This essay underlined the success of strategies based on endogenous capabilities and the linkages with the environment in order to properly integrate change and innovation activities with the missing knowledge and capabilities from the environment. In the context of National Systems of Innovation and a shortage of resources—a typical condition in developing countries—promoting the relationship and activities between actors could be far more relevant than just strengthening each actor's capacities. The experiences analyzed made this point clear.

Finally, in the context of the innovation "scenario" (where activities took place and innovations emerged from), the paper, first, analyzed the "consensus space," and second, the "social context" surrounding innovation activities. On the former, the analysis revealed the value conferred to the physical and to perceptions (testing environments, prototyping, mechanisms that translate individual knowledge to collective knowledge and the crucial role of pace of innovation activities). On the latter, the paper focused on different aspects of the "social context" of innovation activities (organizational cognition and learning [Nonaka, 1994], interaction-iteration, learning communities, dialogue construction).

The paper suggests new lines of research on the realm of "relational capital," not just as an asset to be promoted by the system as whole, but specially by each actor. In the context of the actors, and in order to promote such capital, special attention must be paid to studying how actors could assign "meaning" and "value" to "relations" in the course of routines and innovation activities.

Under a National System of Innovation that promotes change, innovation and competence building, a sound understanding of those aspects that bring meaning to relations with others and how these relations are integrated into both routines and innovation could lead to policies that focus on generating "agents" of change and innovation and that stress their interactions instead of continuing, as is the case of most developing countries, with policies that foster each actor's rigidity by strengthening his or her capacities and boundaries, as if they were autonomous and self-sufficient entities that neither needed others nor took part in any system at all. Such policies could be counter to the idea of a system, where the whole is more than the sum of its parts (Lundvall, 2007), and the globalization dynamics we witness today, as clearly stated by Nelson: "The new evolutionary growth theory that is emerging sees economic growth as the result of the co-evolution of technologies, firm and industry structures, and supporting and governing institutions." (Nelson, 2007).

The second issue for further research is the need to explore how to articulate the evolutionist's theories with the firm's choice and intention as to change and innovation. This articulation will provide substantial understanding on how organizations could "migrate" from a reactive approach to a proactive approach and, later, to a forecasting approach in their dynamic of change and evolution. Such research should encompass not just specific innovation projects but, above all, innovation plans and programs, as it's been rightly underscored by the British Standard (BS 7000-1:1999). For example, choosing innovation for its externalities potentialities (those attached to other innovations or other domains of the business). This is an area where alternatives and research possibilities could make a significant contribution to organizational innovation and the firm's choice in an integral approach.

Finally, further research could lead to the development of a better understanding of artifacts (translating individual knowledge into collective knowledge), and particularly digital artifacts, given the great versatility of IT and the widespread use of such technologies in people's workplaces and planning activities in organizations.

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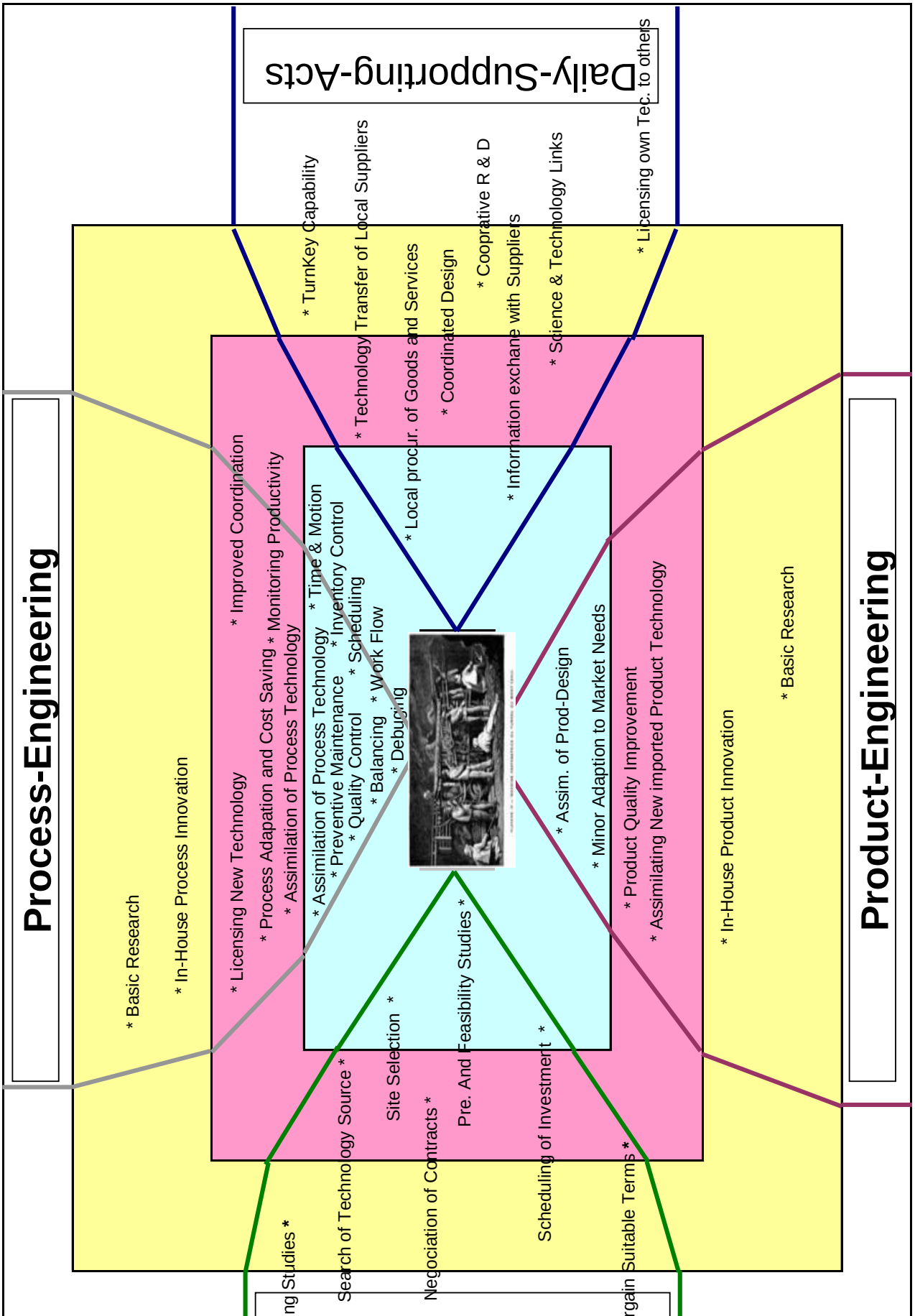
Daily-Supporting-Acts
* TurnKey Capability
* Technology Transfer of Local Suppliers
* Coordinated Design
* Cooprative R & D
* Information exchane with Suppliers
* Science & Technology Links
* Licensing own Tec. to others
Process-Engineering
* Basic Research
* In-House Process Innovation
* Licensing New Technology
* Improved Coordination
* Process Adapation and Cost Saving
* Monitoring Productivity
* Assimilation of Process Technology
* Assimilation of Process Technology
* Time & Motion
* Preventive Maintenance
* Inventory Control
* Quality Control
* Scheduling
* Balancing
* Work Flow
* Debugging
* Local procur. of Goods and Services
* Assim. of Prod-Design
* Minor Adaption to Market Needs
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